

# Successful Endovascular Treatment of Pulsatile Tinnitus Caused by a Sigmoid Sinus Aneurysm

## A Case Report and Review of the Literature

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### Summary

*We describe the case of a 48-year-old woman who presented with a sigmoid sinus aneurysm. These rare entities have only recently been described in the literature and the ideal treatment approach has not been elucidated. This report represents additional evidence in a growing body of literature that suggests that endovascular therapy is a safe and effective therapeutic alternative to surgical reconstruction of the sigmoid sinus in selected cases of intractable pulsatile tinnitus.*

### Introduction

Transverse-sigmoid sinus aneurysms are a rare cause of pulsatile tinnitus. These venous malformations are variably referred to as aneurysms or diverticula in the existing literature. These lesions have been treated by a number of operative approaches, but only relatively recently have reports of successful endovascular treatment been published<sup>1-3</sup>. We describe the case of a 48-year-old woman who underwent successful, single-stage endovascular treatment of a sigmoid sinus aneurysm.

### Case Report and Technique

The patient is a 48-year-old woman who presented to her otolaryngologist with intractable pulsatile tinnitus and decreased hearing on the

left of several months duration. She found the symptoms to be increasingly disruptive, as she was often awoken from sleep. The patient reported concomitant headaches and denied any nausea, vomiting or visual symptoms. Her medical history was unremarkable. The fundoscopic and otoscopic examinations were normal. Cranial auscultation revealed no bruits over the eyes, forehead, or periauricular regions. Of note, compression of the left internal jugular vein (IJV) eliminated the tinnitus. The patient had no cranial nerve deficits. The remaining physical examination was unremarkable.

Radiographic examination included MRI of the skull base which demonstrated asymmetry of the jugular bulbs, with the left being larger than the right. CT angiography revealed a bony defect with contrast emanating into the posterosuperior aspect of the mastoid region (Figure 1). At this stage the patient was referred for cerebral angiography. The cerebral angiogram demonstrated a left-sided sigmoid sinus venous aneurysm projecting laterally measuring 6 x 6 mm (Figure 2).

Due to the patient's debilitating symptoms and the high likelihood that the venous sinus aneurysm was the cause of her symptoms, endovascular treatment versus open surgical treatment was proposed. Coil embolization of the aneurysm was undertaken under general anesthesia. The patient was heparinized to achieve an activated clotting time twice baseline. A 5 French Envoy guide catheter (Cordis

Corp., Warren, NJ, USA) was navigated into the left IJV after femoral vein puncture. A 90 degree Prowler-14 microcatheter (Cordis Corp., Warren, NJ) was navigated over a Synchro-14 microwire (Boston Scientific, Natick, MA) into the venous aneurysm under road map guidance. Complete occlusion of the venous aneurysm was achieved with a 5 x 10 Tetrus 3D Tension Safe (ev3, Plymouth, MN, USA) and three Supersoft (ev3, Plymouth, MN, USA) coils sized 3 x 4, 4 x 6, and 3 x 6, respectively. The subsequent venogram demonstrated total occlusion of the aneurysm with no residual filling as well as normal flow through the sinus with no evidence of thrombus formation (Figure 3). The patient noted immediate resolution of her tinnitus in the recovery room. Aspirin therapy (325 mg per day) was initiated and continued for six weeks postoperatively. The patient was observed overnight and subsequently discharged home the following day. At the time of this writing the patient remains asymptomatic one year after the procedure.

## Discussion

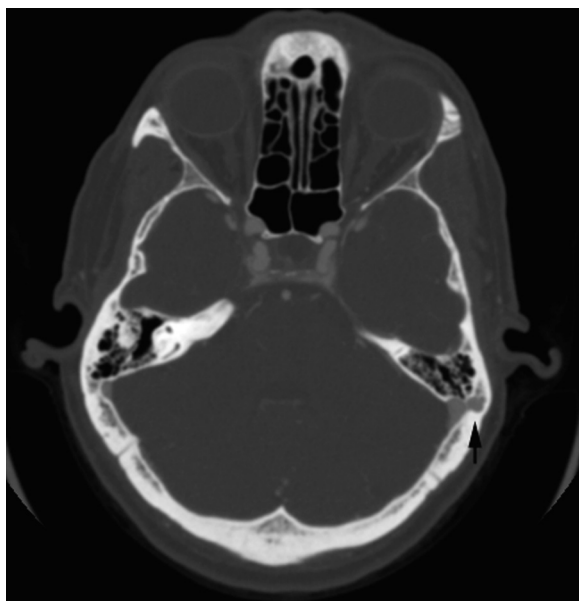
Tinnitus is a common condition, affecting up to 10% of the U.S. population, and is equally prevalent in men and women<sup>3,5</sup>. While several categorizing schema exist, tinnitus can simply be divided into non-pulsatile or pulsatile (rhythmic). Tinnitus of either subtype bespeaks a broad differential diagnosis, but a thorough history and physical examination may be useful in determining its etiology. Radiographically, CT angiography/venography is very useful in evaluating pulsatile tinnitus<sup>4</sup>.

The differential diagnosis of pulsatile tinnitus is largely vascular<sup>5,6</sup>. Arterial causes include both intra- and extracranial atherosclerosis, dural arteriovenous fistula, persistent stapedia artery, Paget's disease, hyperdynamic states (eg. thyrotoxicosis, pregnancy) and glomus tumors. Idiopathic intracranial hypertension (pseudotumor cerebri), high-riding jugular bulb, transverse-sigmoid sinus stenosis, and abnormal mastoid emissary vein are known venous contributors.

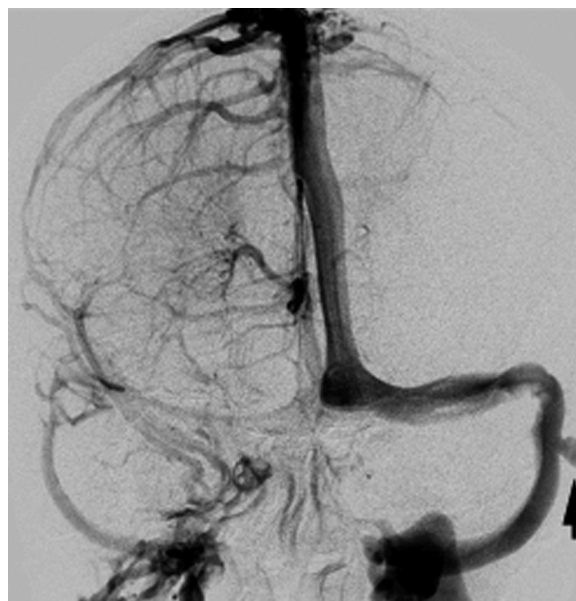
Sigmoid sinus aneurysms as a cause of pulsatile tinnitus have been described only relatively recently<sup>1,3,7-9</sup>. Little is known about the underlying pathophysiology or natural history of these lesions. The exact incidence is unclear and currently available reports are quite variable. One study examined 223 thin-cut tempo-

ral bone CT scans and identified a number of intracranial venous abnormalities but not a single sigmoid sinus aneurysm, although it should be noted that tinnitus was the indication in only 5% of the scans examined<sup>10</sup>. Otto et Al published a retrospective review of 43 patients evaluated for pulsatile tinnitus<sup>7</sup>. They identified five cases of sigmoid sinus aneurysm. Another recent study suggested that intracranial venous lesions may be the most common cause of pulsatile tinnitus<sup>4</sup>. Including the present report, eleven cases of venous sinus aneurysms have been described in the literature to our knowledge. Of the eleven case descriptions available, evidence of associated ipsilateral transverse sinus (TS) stenosis proximal to the lesion or contralateral TS hypoplasia is noted in six cases, while that information is not available in the remaining five. This observation lends credence to the hypothesis that sigmoid sinus diverticula are related to increased and/or turbulent flow in the affected sinus.

Successful surgical and endovascular treatment of sigmoid sinus aneurysms has recently been described<sup>1,3,7-9</sup>. Of the five patients with sigmoid sinus aneurysms described by Otto et Al, three elected to undergo transmastoid reconstruction of the sigmoid wall. There is no mention, however, as to whether an endovascular treatment option was alternatively presented to these patients. Among the patients who elected to undergo surgical reconstruction of the sigmoid wall, each had resolution of symptoms and no complications beyond hemotympanum were reported. Thus, this case series also describes a successful, albeit more invasive approach to treating venous sinus aneurysms. In 2000, Houdart et Al described the successful endovascular treatment of a sigmoid sinus aneurysm via a transjugular approach in a 33-year-old woman. Selective coil embolization of the venous aneurysm was performed with immediate complete resolution of symptoms<sup>1</sup>. In 2002, Sanchez et Al described the endovascular treatment of a 54-year-old, in which stent-assisted coil embolization was performed. Again immediate and complete resolution of pulsatile tinnitus was noted following the procedure. In 2004, Zenteno et Al described the treatment of a transverse-sigmoid sinus aneurysm in a 38-year-old woman<sup>3</sup>. In this case, a stent was placed across the aneurysm neck via a transthoracic approach with initial resolution of symptoms. Recurrence of symptoms, however, prom-



*Figure 1* Axial CT with contrast demonstrating venous aneurysm (arrow) in the posterosuperior aspect of mastoid region.



*Figure 2* AP projection of venous phase of cerebral angiogram demonstrating a narrow-necked sigmoid sinus aneurysm (arrow).

pted subsequent coil embolization with complete and sustained resolution of symptoms. In 2009, Gologorsky et Al described the treatment of a transverse-sigmoid sinus aneurysm in a 48-year-old woman<sup>9</sup>. An endovascular approach was attempted initially, however this approach was aborted due to coil migration. A stent-assisted embolization as previously described in the literature<sup>3,8</sup> was reportedly considered, but not attempted due to concerns with potential thrombosis. Therefore, a surgical reconstruction of the sinus was performed with minimal subsequent sinus stenosis<sup>9</sup>.

We describe the case of a 48-year-old woman who underwent successful endovascular treatment for debilitating pulsatile tinnitus caused by a sigmoid sinus aneurysm. Based on the currently available literature endovascular coil embolization is a safe and ultimately successful treatment with immediate relief of the pulsatile tinnitus associated with this lesion. Also, as previously described, a stent-supported coil embolization may be useful in a wide-necked venous aneurysm<sup>3,8</sup>. A distinct disadvantage of this approach is the risk associated with long term antiplatelet therapy as well as the risk associated with stent deployment. Therefore, we would recommend avoiding stent placement unless absolutely indicated, or when coil embolization by itself is technically not feasible.

Proponents of the surgical approach have argued that endovascular therapy poses the risk of venous sinus thrombosis<sup>7,9</sup>. Although this is a valid concern, it has not been borne out in the limited available literature and will have to be studied further.



*Figure 3* Post-embolization venogram revealing coil mass within the sigmoid sinus aneurysm (arrow). There is no filling of the aneurysm and no evidence of thrombosis in the sinus adjacent to the coil mass.

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